BUT DF
4.1 v1
01/01/1971

REFERENCE 8

Brooks, Howard C., 1971, State of Oregon, Department of Geology and Mineral Industries, *Quicksilver Deposits in Oregon*, 8 pages.

MISCELLANEOUS PAPER 15

QUICKSILVER DEPOSITS IN OREGON

QUICKSILVER DEPOSITS IN OREGON

by

HOWARD C. BROOKS

1971

MISCELLANEOUS PAPER 15

Issued by
State of Oregon
Department of Geology and Mineral Industries
Portland, Oregon
R. E. Corcoran, State Geologist

QUICKSILVER DEPOSITS IN OREGON

By Howard C. Brooks

INTRODUCTION

This map is designed to replace an out-of-print publication prepared by Francis Frederick (1945). Revision of the Frederick inventory is based on field investigations by Brooks (1963: out of print) and subsequent data in files of the Oregon Department of Geology and Mineral Industries. Some deposits may have been overlooked in compiling the present map; if so, the Department would appreciate receiving information about them and also about any discoveries that may be made in the future.

The following text summarizes briefly the salient geologic features of the principal quicksilver-bearing areas and the larger mines in Oregon. Persons interested in more specific information are referred to the appropriate publications mentioned in the text and listed in the bibliography.

ECONOMICS OF THE QUICKSILVER INDUSTRY

Quicksilver, also known as mercury, is a silvery white metal that is liquid at ordinary temperatures. Its unique combination of physical and chemical properties makes it useful in the manufacture of a multitude of industrial, chemical, and military products. For many of its uses there are no substitutes. Thus, while it ranks only tenth in quantity in world output of nonferrous metals, the importance of mercury to our national welfare is enormous.

World production

During 1960-1970 annual world output of quicksilver averaged about 250,000 flasks; United States annual consumption averaged 71,000 flasks, whereas production averaged 24,800 flasks, or about 29 percent of consumption. Spain and Italy dominate world production and usually are able to control the market price of quicksilver. Because world sources of quicksilver are concentrated in a few areas, imbalances often occur in supply and demand. Consequently quicksilver prices tend to fluctuate rapidly and are followed closely by a corresponding increase or decrease in domestic production. For this reason, quicksilver mining in the United States is considered a highly unstable industry.

Military industry demands during both world wars caused great increases in mercury prices and production. When these hostilities ended, rapidly accumulating stocks resulted in major price and production slumps. Domestic production dropped from 51,929 flasks in 1943 to 4,535 flasks in 1950. More recent highs and lows in annual production were 38,067 flasks in 1958, 14,142 in 1964, and 29,360 in 1969. Extremes in annual price averages were $81 per flask in 1950, $290 in 1955, $189 in 1963 and $570 in 1965. The monthly price average for June 1971 was $266 per flask. The unprecedented high prices during the mid-1960's were due to a supply-demand pinch resulting from long-depressed prices. The general price decline which began in 1970 is due in part to the recognition that some uses of mercury are damaging to the environment.

Wide price and production fluctuations have characterized the mercury market for more than fifty years and there is little evidence to indicate that the conditions will change greatly in the near future. On the other hand, demand for mercury both in the United States and in the world can be expected to continue to increase (Bailey and Smith, 1964). Production costs in Spain and Italy are also increasing and mercury prices should continue to rise to higher levels of fluctuation. Therefore, domestic producers should continue to maintain their normal share of the market.

Oregon production

Oregon mines have produced about 108,000 flasks of quicksilver, or roughly 3 percent of total United States output through 1970. Of this amount, nearly 105,000 flasks have been produced since 1927. Oregon output has closely followed the cycles of United States production. The annual output for 1927 through 1945 averaged 4,265 flasks, with a peak of more than 9,000 flasks from 20 mines in both 1940 and 1941. World oversupplies following World War II resulted in closure of nearly all domestic mercury mines; Oregon's production in 1950 was seven flasks. High prices brought about by the Korean conflict revitalized the industry, and 3,993 flasks were produced from eight mines in 1957. Thereafter, output dwindled to four flasks in 1963. Oregon's response to the most recent price escalation, which began in late 1963, was a total output of 4,071 flasks during 1964-1968, mostly from old mines. Production since 1968 has been from limited operation of small mines and prospects.

Over 90 percent of Oregon's production was contributed by five mines: Bonanza in Douglas County; Black Butte in Lane County; Horse Heaven in Jefferson County; and Bretz and Opalite in southern Malheur County. The Bonanza was the largest producer, with an output of about 39,540 flasks. Yield from the other four ranged from 12,000 to 18,500 flasks each. No other mine produced more than a thousand flasks.

OCCURRENCE OF QUICKSILVER

Mineralogy and origin

The principal mercury ore mineral is the red sulfide, cinnabar (HgS). Native mercury and, more rarely, metacinnabar, schwatzite, livingstonite (?), and chloride and oxychloride of mercury, have been found in some deposits in Oregon. The iron sulfides, pyrite or marcasite, are common gangue minerals though rarely abundant. Sulfides of other metals are scarce. Calcite and chalcedony are usually present; more rarely opal or fine-grained quartz are found in the deposits.

Mercury deposits are found chiefly in regions of Tertiary and Quaternary orogeny and volcanism. The mercury minerals were deposited from mineralized hot waters, which probably were genetically related to certain phases of the magmatic activity responsible for the volcanism. The hot solutions rose along faults and other zones of broken rock and the mercury minerals were deposited in fractures and voids and in places replaced the host rocks as the solutions cooled or otherwise changed in character on nearing the surface. Near many deposits the rocks have been greatly altered in composition and appearance by the ore-forming solutions. Clay, silica, and carbonate minerals are the principal products of the alteration. Mercury ore bodies probably formed nearer the surface and at lower temperatures than the ores of most other metals deposited from hydrothermal solutions, and few deposits extend to depths greater than a thousand feet.

Prospecting guides

Cinnabar has a high specific gravity and is resistant to chemical decomposition. It therefore tends to concentrate in alluvium along streams and slopes during the weathering of the host rock. Most quicksilver deposits were discovered by prospectors using a gold pan to trace cinnabar float to its source. More refined tests depend on systematic sampling of soils and stream sediments in a mineralized area. The samples are then subjected to chemical tests which are capable of detecting extremely small quantities of mercury.

The best places to prospect for new quicksilver deposits are in areas that have a history of significant production. Knowledge of the geologic environment of important deposits is invaluable in the search for favorable lithologic and structural conditions, and the experienced quicksilver prospector has learned to recognize the types of rock alteration that are associated with quicksilver deposits. Each type of rock commonly exhibits a characteristic kind of alteration. Porous rocks that were originally high in silica, such as rhyolitic tuffs and tuffaceous sediments, commonly are silicified. The maximum effect of this type of alteration is the formation of masses of chalcedony and opal hundreds of feet across. Less silicious rocks, including andesite flows, tuffs and breccias, typically are more rich in clay and carbonate minerals than in silica.

Distribution of Oregon deposits

More than 99 percent of the quicksilver produced in Oregon has come from deposits in rocks of Tertiary age. The host rocks include volcanic flows, volcaniclastic breccias and conglomerates, volcanic plugs, tuffs, tuffaceous lakebeds, and marine and nonmarine sandstones. The volcanic rocks are predominantly of andesitic to rhyolitic composition. Although a few mercury deposits occur in basaltic rocks along the western edge of the Cascade Range, the plateau-forming basalts that cover so much of the state east of the Cascades are remarkably unmineralized. Numerous small mercury occurrences have been found in pre-Tertiary rocks, in both the Klamath Mountains and the Blue Mountains, but few have been productive.

Quicksilver deposits are concentrated in the southwestern, central, and southeastern parts of Oregon. Only a few occurrences are known in northwestern and northeastern Oregon. In the following discussion the deposits are grouped by counties according to the major subdivisions of the state: 1) southwestern, 2) central, 3) southeastern, and 4) northwestern and northeastern combined. Only the more important districts and mines shown on the locality map are described below.

SOUTHWESTERN OREGON

In southwestern Oregon most of the mercury deposits lie close to the boundary between the Cascade Range to the east and the Coast Range and Klamath Mountains to the west. Host rocks include the thick series of upper Eocene to lower Miocene pyroclastics and lavas of the Western Cascades, earlier Eocene marine sediments of the Coast Range and pre-Tertiary metamorphic and igneous rocks of the Klamath Mountains. The Bonanza and Black Butte mines at the northern end of this belt account for more than half of the state's total mercury production.

Lane County

Block Butte mine: The Black Butte deposit, about 17 miles south of Cottage Grove, is in andesitic lavas, breccias, and tuffs of the Calapooya (or Fisher) Formation of late Eocene and Oligocene age (Wells and Waters, 1934; Waters, 1945). The principal ore zone lies along a normal fault whose surface expression coincides with the crest of Black Butte. The dip of the fault averages about 58°. Subordinate faults are distributed through a wide zone both above and below the main fault, and the intervening rocks are extensively brecciated and altered. Veinlets of quartz and carbonate minerals, thickly massed in the fault zone, are more resistant to erosion than the enclosing rocks and are responsible for the topographic development of the Butte. Cinnabar occurs as irregular veinlets and disseminations scattered through most of the broken and altered rock. The grade of ore is highest in material that was silicified and brecciated prior to the introduction of cinnabar. The Block Butte mine is developed by adits distributed over a vertical interval of about 1,300 feet. The principal ore shoot has been worked from surface outcrops to the 1,100-adit level, a vertical distance of about 850 feet. In 1967 - 1968 ore was mined on the 1,250-adit level. The average ore recovery has been about $3\frac{1}{2}$ pounds of mercury per ton.

Douglas County

Elkhead mine: At the Elkhead mine in Douglas County, a few miles southwest of Block Butte, cinnabar occurs in a shear zone along a steeply dipping contact between basalt and overlying sandstones and shales of the Umpqua Formation of Eocene age. Limited open-pit operations at this mine accounted for most of Oregon's small quicksilver production in 1969-1970.

Bonanza district: The quicksilver deposits in the Bonanza district are in a sequence of marine sandstone, conglomerate, and shale of the Umpqua Formation. The ore bodies occur in fractured and intensely altered tuffaceous sandstone. Differential movement during the formation of an anticline developed fractures in the sandstone which were later mineralized (Brown and Waters, 1951). At the Bonanza mine the ore bodies were formed along bedding-plane shear zones close beneath a layer of relatively impervious shale, which may have aided in localizing the mineralizing solutions. At the Nonpareil mine the shear zone cuts tuffaceous sandstone stratigraphically lower in the section, and the ore bodies were localized by cross faults.

The average dip of the mineralized shear zone at the Bonanza mine is about 45°. Subordinate faults of diverse trend served to spread the solutions throughout the zone of fracture. The ore bodies consist almost entirely of sheared and argillized sandstone which is veined and impregnated with calcite, siderite, quartz, and cinnabar. A little metacinnabarite and native mercury also are present. The ore zone in the upper levels of the mine was about 600 feet long and as much as 60 feet thick. It narrowed considerably below the 370-foot level and locally was not of mining width. Ore has been mined to a dip depth of 1,450 feet. The mine closed in 1961 and the lower levels are flooded.

Tiller district: The deposits northeast of Tiller are in pyroclastics and lavas of the Western Cascades volcanic series. A few flasks of quicksilver have been produced at the Bueno Vista and Maud S. mines, where cinnabar and pyrite are associated with calcite and chalcedony veinlets in fault zones rich in clay and carbonate minerals. The fault zone at the Bueno Vista mine is 5 to 17 feet wide. Other prospects in the Tiller district explore small fault and shear zones containing calcite, chalcedony, and a little cinnabar along fractures.

The small quicksilver deposits in the Upper Cow Creek drainage south of Drew are in metamorphic rocks of the Triassic Applegate Group. The Red Cloud mine produced 63 flasks from shear zones along a fault in amphibolite and quartz-mica schist. The shear zones, 4 or 5 feet in average width, consist largely of limonitized clay gouge and sheared rocks containing stringers and small bunches of calcite, a little quartz, pyrite, and cinnabar.

Jackson County

Trail district: Most of the deposits along the Rogue River east of Trail and in the Brownsboro and Shale City areas to the south are in gently dipping volcanic rocks of the Western Cascades. No records of production are available. In most of the deposits cinnabar is concentrated in veinlets of calcite and chalcedony filling fractures in altered lavas and tuffs. Less than one mile north and west of Shale City cinnabar occurs in scattered masses of opalite derived from the silicic alteration of pyroclastic rocks.

Meadows district: In the Meadows district, about 10 miles west of Trail, the deposits lie within a broad zone of minor normal faults on both sides of a faulted contact between metamorphic rocks of the Applegate Group and upper Eocene continental sediments. The district has produced about 950 flasks of mercury. Nearly three-quarters of it was obtained from the Rainier vein at the War Eagle mine, where cinnabar and pyrite fill fractures in a brecciated quartz vein 3 to 10 feet wide in sheared amphibolite. At the Mountain King mine more than 95 flasks were produced from small ore bodies in crushed and altered amphibolite and mica schist along two well-defined shear zones that range up to 10 feet in width. In the Eocene rocks quicksilver has been produced from deposits along faults in arkosic sandstone at the Cinnabar Mountain mine, on the Chisholm claims, and in fractured coal seams in the War Eagle mine. At the Dave Force and Palomar prospects cinnabar occurs in altered diabase dikes.

Upper Applegate district: The deposits in the Upper Applegate drainage south of Medford are in pre-Tertiary metamorphic and intrusive rocks. Many occurrences have been prospected but none has produced more than a few flasks of quicksilver. Typically the deposits occur in small irregular fault and shear zones that locally contain gouge seams and small concentrations of calcite and quartz. Cinnabar is observed as crystalline aggregates in the calcite and quartz and as veinlets, fracture coatings, and disseminations in the gouge and adjacent fractured wallrocks. Commonly, there is also wide distribution of small amounts of cinnabar along joints, schistose partings, bedding planes, and other minor fractures, most of which are related to the intense regional deformation of the host rocks. Pervasive fracturing of the host rocks probably permitted wide dispersal of the mineralizing solutions and may thus account for the large number of small deposits.

Josephine and Curry Counties

The several little-developed quicksilver prospects in Josephine and Curry Counties occur chiefly in Jurassic and Cretaceous volcanic and sedimentary rocks. Cinnabar is associated with peridotite and serpentine in the Red Flats area in Curry County and is finely dispersed along joint fissures in propylitized diorite in the Diamond Creek placers in extreme southwestern Curry County.

Most of the quicksilver deposits in central Oregon lie in Jefferson and Crook Counties within 35 miles of Prineville. The region is underlain chiefly by thick accumulations of lavas, pyroclastics, and water-laid tuffaceous sediments that range from late Eocene to Pleistocene in age. Intrusive plugs and dikes are locally abundant. Most of the quicksilver deposits are in rocks of the Clarno Formation of late-Eocene-to-early Oligocene age. Many are closely associated with post-Clarno intrusive bodies. The volcanic and intrusive rocks in the quicksilver-bearing areas are predominantly andesitic but basalts and rhyolites also are common. The plugs vary considerably in resistance to erosion. Many stand in bold relief as semi-cone-shaped peaks. Some of those that are

associated with quicksilver deposits are less conspicuous due to the softening effect of hydrothermal alteration. Intrusives or parts of intrusives that are poorly exposed are believed to be especially suitable areas in which to prospect for new ore bodies.

Jefferson County

Horse Heaven district: The Horse Heaven mine in eastern Jefferson County has been by far the most productive quicksilver mine in central Oregon and is the third largest producer in the state. The ore bodies occur in and along the edge of a biotite-rhyolite plug and subsidiary protrusions (Waters and others, 1951). As the plug rose, the overlying Clarno and post-Clarno rocks were domed, and both the rhyolite and the wall rocks were extensively fractured. These zones of broken rock were later altered and mineralized. Much of the ore lay beneath an ancient clay soil horizon which developed at the surface of the Clarno Formation. This horizon is now buried beneath younger rock but in many places is in contact with the southwestward-pitching margin of the plug. The ore zone is about 1,300 feet long. Little ore was found at depths greater than 400 feet, despite extensive deeper exploration, even though there was no apparent change in the character of the host rocks or in the structure. The mine was closed in 1958. Total production was 17,216 flasks from 128,216 tons of ore. The principal mine workings are completely caved.

At the Axehandle mine, about 10 miles west of the Horse Heaven mine, cinnabar mineralization was associated with the intrusion of an andesite plug which forms the core of Axehandle Butte. Ore was localized chiefly along shear zones in adjacent older andesite flows.

Crook County

Ochoco district: East of Prineville a broad zone of faulting, shearing, and hydrothermal alteration extending N. 50° E. along Ochoco Creek for about 6 miles includes the Byram-Oscar, Staley, Champion, and Taylor Ranch mines. About 6 miles to the southeast a similar zone extends N. 60° E. along Johnson Creek for about 4 miles, including the Mother Lode, Amity, Number One, and Blue Ridge mines. Collectively these 8 small mines have produced about 2200 flasks of quicksilver. Rocks in the mineralized areas typically are cut by several systems of small faults and fractures which may represent different stages in the regional deformation of the Clarno Formation in this area. No faults are known to be continuous for more than a few hundred feet. Ore mineralization generally is associated with faults striking about N. 60° E. Ore bodies tended to localize at intersections with younger fracture systems and in places, particularly at the Mother Lode mine, cross faults were the principal site of ore deposition. Post mineral faults locally complicate the structure of the ore bodies.

The ore consists mainly of soft, clay-rich fault gouge irregularly impregnated with small amounts of calcite and chalcedony. Locally the wall rocks are partly silicified. Pyrite is widespread but not abundant. Gilsonite(?) is a very minor constituent locally. Cinnabar forms thin seams, fracture coatings, and minute crystal aggregates. It commonly fills fractures in calcite or chalcedony veinlets. Some of the gouge zones exceed 20 feet in width but most average less than 5 feet. Characteristically the mined ore bodies were small pods, lenses, and nearly vertical shoots a few tens of feet in longest dimension.

The Strickland Butte and Barnes Butte prospects are along faults cutting Clarno tuffs and lake beds adjacent to rhyolitic plugs.

Maury Mountain district: The adjoining Maury Mountain and Towner mines in southern Crook County have produced about 800 flasks from small ore bodies in Clarno tuffs near a basaltic andesite plug. Mineralization is associated with an arcuate zone of small irregular faults bordering the northern, eastern, and southwestern margins of the plug. The fractured tuffs have been mildly silicified and carbonatized and, being thus more resistant, the fault zone is marked by low ridges bordering the plug. Cinnabar, generally associated with a little chalcedony, calcite, and pyrite, was deposited locally as pods and lenses along the faults, particularly at points where faults converge, intersect, or change abruptly in attitude. Ore produced has averaged about 12 percent quicksilver. From one of the ore bodies 5,000 pounds of mercury was recovered from 26,000 pounds of ore.

Bear Creek district: South of Prineville Reservoir in the Bear Creek drainage cinnabar is associated with altered fault zones in Clarno lavas and tuffs. From the Platner mine, the largest producer, 24 flasks were recovered from several small cinnabar occurrences along a prominent silicified fault zone that is traceable for more than a mile.

SOUTHEASTERN OREGON

Malheur County

Opalite district: In southeastern Oregon the principal mercury mines are the Bretz and Opalite in the Opalite district in Malheur County. In the same district, across the Nevada line, is the Cordero mine, which for many years was one of the Nation's leading producers. The deposits are in altered tuff and tuffaceous lakebeds of Miocene age. In places adjacent to faults the tuffs and lakebeds have been silicified to opalite, a light-colored rock consisting of a mixture of chalcedony, quartz, and opal. The Opalite mine ore body occurs in a flat mass of opalite about 1,200 feet long, 800 feet wide, and more than 100 feet in maximum thickness. Yates (1942) inferred that the silica was deposited largely as opal, which converted to chalcedony and fine-grained quartz. Parts of the silicious mass were fractured extensively as a result of shrinkage brought about by dehydration of the opal. During a late stage in the process, finely divided cinnabar accompanied by silica filled fractures in the chalcedony. At the Bretz mine, several small but relatively high-grade ore bodies occur along faults in lakebeds and tuffs. Large and small masses of opalite are closely associated with the ore bodies but contain little or no cinnabar. Since the quicksilver solutions are believed to have followed the same channels as the silicifying solutions, it seems probable that fracturing similar to that at the Opalite deposit did not exist or that earth movements were insufficient to hold them open during the time cinnabar was being deposited. Consequently the mineralizing solutions were diverted into adjacent unsilicified rocks. The Bretz ore bodies have been mined by open pit; the Opalite ore bodies were mined by the glory-hole method. Ore has not been found at either mine below a depth of about 100 feet, although at the nearby Cordero deposit the depth of mining exceeds 800 feet. Deep drilling at the Opalite deposit encountered some massive pyrite.

Lake County

Glass Buttes district: Rocks in the Glass Buttes area are chiefly glassy rhyolitic flows, pumiceous tuffs, and breccias of Tertiary age. Mineralization is associated with broad northwest- to west-trending fault zones in which some of the rocks have been opalitized. Cinnabar, generally finely dispersed in a matrix of silica, was deposited along faults and in breccia zones in both silicified and unsilicified rocks. Low-grade cinnabar mineralization is widely scattered. Small bodies of rich ore are found locally. Some mining, mostly open pit, has been done at three localities in an area that is more than a mile across. Production totals 596 flasks, mostly during 1967-1968.

Quartz Mountain area: The Quartz Mountain area is underlain by a complex series of interrelated acid volcanic rocks including restricted flows, tuffs, plugs, and both intrusive and extrusive breccias of Tertiary age. Several structurally obscure opalitized zones have been prospected and small amounts of cinnabar have been found locally. Production has been about 50 flasks, mostly from the Angel Peak mine. Geochemical soil analyses indicate that the rocks in parts of the area contain higher concentrations of mercury than is normal for acid volcanic rocks.

Harney County

Steens-Pueblo district: Many small deposits occur in southern Harney County in a narrow belt extending about 40 miles northward from the Nevada state line along the lower eastern flanks of the Steens and Pueblo Mountains (Ross, 1942; Williams and Compton, 1953). Total production from these deposits has been only about 75 flasks. At the northern end of the district on the slopes of Indian, Toughey, and Pike creeks are several deposits in which cinnabar occurs in small pockets or seams along narrow, well-defined breccia zones or open fractures in rhyolitic rocks. Between Andrews and Fields, a distance of about 12 miles, there is a multitude of minor occurrences of cinnabar and mercury-bearing tetrahedrite and other copper minerals in long, narrow reefs of brecciated and silicified andesite. These reefs, which formed by silicification along faults, are more resistant than the enclosing rocks and as a result form prominent ridges as much as 25 feet wide and up to half a mile in length. On the eastern slope of the Pueblo Mountains, several deposits occur in reefs similar to those of the Fields-Andrews area except that the mineralized rocks are metamorphosed sediments and volcanics of pre-Tertiary age.

NORTHWESTERN AND NORTHEASTERN OREGON

In northwestern Oregon the principal deposits are the adjoining Nisbet and Kiggins mines on the Oak Grove Fork of the Clackamas River in Clackamas County. The deposits are in massive, fine-grained-to-glassy Columbia River Basalt flows of Miocene age. The combined production from these deposits has been 173 flasks. Cinnabar occurs in several well-defined banded fissure veins consisting mainly of calcite. In one of the veins, calcite is subordinate to stilbite, one of the zeolite minerals. The veins range from 6 inches to 6 feet in width and locally converge to form mineralized zones 10 to 15 feet wide. Crystal interspaces in the veins commonly are filled with felted mixtures of quartz, opal, heulandite or stilbite, calcite, and locally pyrite, ilsemannite, jordisite, and cinnabar.

In northeastern Oregon production of about 115 flasks has been almost entirely from the Canyon Creek mine in Grant County, which was discovered in 1963. There the host rocks are interbedded graywacke and siltstone of Late Triassic age. Small but rich ore bodies are associated with zones of fracturing along steeply plunging fault intersections. Mineralization also spread laterally along the faults and bedding plane fractures. The rocks have been partly altered to clays and locally silicified.

SELECTED BIBLIOGRAPHY

Bailey, E. H. and Smith, R. M., 1964, Mercury - its occurrence and economic trends: U. S. Geol. Survey Circ. 426, 11 p.

Brooks, H. C., 1963, Quicksilver in Oregon: Oregon Dept. Geology and Mineral Industries Bull. 55, 223 p.

Brown, R. E. and Waters, A. C., 1951, Quicksilver deposits of the Bonanza-Nonpareil district, Douglas County, Oregon: U. S. Geol. Survey Bull. 955-F, p. 225-251.

Frederick, Francis, 1945, State of Oregon map showing location of quicksilver deposits: Oregon Dept. Geology and Mineral Industries, scale 1:1,000,000.

Ross, C. P., 1942, Quicksilver deposits in the Steens and Pueblo Mountains, southern Oregon: U. S. Geol. Survey Bull. 931-J, p. 227-258.

Schuette, C. N., 1938, Quicksilver in Oregon: Oregon Dept. Geology and Mineral Industries Bull. 4.

Waters, A. C., 1945, The Black Butte quicksilver mine, Lane County, Oregon: U. S. Geol. Survey Strategic Minerals Inv. Prelim. Report 3-186, 4 p.

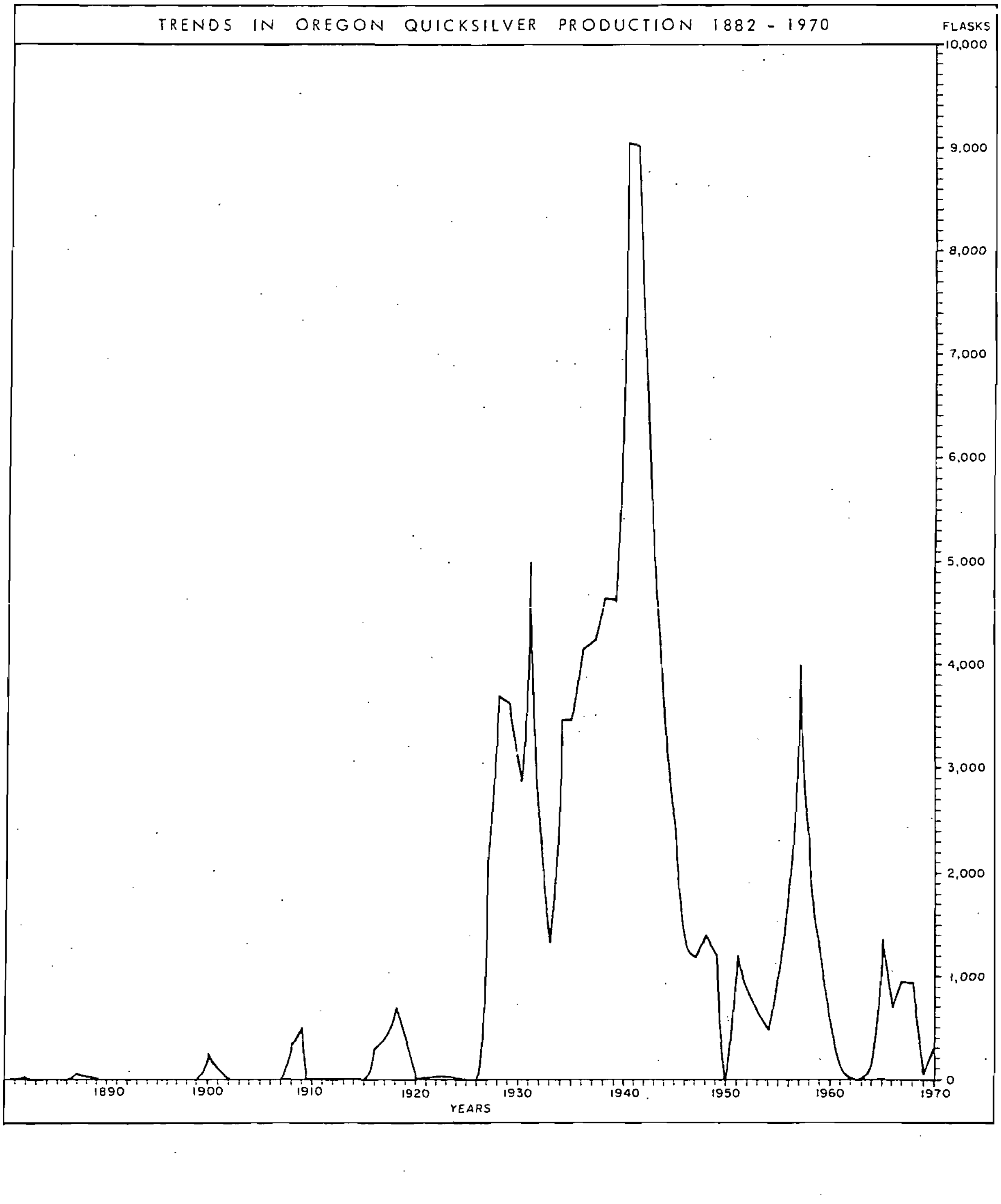
________, Brown, R. E., Compton, R. R., Staples, L. W., Walker, G. W., and Williams, Howel, 1951, Quicksilver deposits of the Horse Heaven mining district, Oregon: U. S. Geol. Survey Bull. 969-E.

Wells, F. G., and Waters, A. C., 1934, Quicksilver deposits of southwestern Oregon: U. S. Geol. Survey Bull. 850, 58 p.

Williams, Howel and Compton, R. R., 1953, Quicksilver deposits of Steens Mountain and Pueblo Mountains, southeast Oregon: U. S. Geol. Survey Bull. 955-B, p. 19-60.

Yates, R. G., 1942, Quicksilver deposits of the Opalite district, Malheur County, Oregon, and Humboldt County, Nevada: U. S. Geol. Survey Bull. 931-N, p. 319-348.

★ ★ ★ ★



TRENDS IN OREGON QUICKSILVER PRODUCTION 1882 - 1970
FLASKS
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
1890
1900
1910
1920
1930
1940
1950
1960
1970
YEARS

	Total Flasks	1970	1969	1968	1967	1966	1965	1964	1963	1962	1961	1960	1959	1958	1957	1956	1955	1954	1953	1952	1951	1950	1949	1948	1947	1946	1945	1944	1943	1942	1941	1940	1939	1938	1937	1936	1935	1934	1933	1932	1931	1930	1929	1928	1927	1882-1926
CLACKAMAS COUNTY																																														
Kiggins Mine	71																														4	5	9	5		12	16	20								
Nisbet Mine	102																												3	3	9	57	5	7	18											
CROOK COUNTY																																														
Amity mine	409														7	46	76				5	6	2	2	8	4	1		2										67	166	17				
Barnes Butte mine	29																												8	19	2														
Blue Ridge mine	259															8	6										3	9	81		54	8	30	15	2			26		10	7				
Byram-Oscar mine	63																																		50	13									
Champion mine	37																													5			2	5	6	12	7								
Maury Mountain mine	609	w	w									2			1	3	36		45	8	9					21	66	36	14		17	24	24	55	30	101	18	24		51						
Mother Lode mine	352											5	6					2											4	2		60	35			47	52			3		23	24	41	24	24
Number One mine[a]	42																															7	4					1			10	20				
Oranogo mine	13																														4	6			3											
Platner mine	45													1				6												16	7	15														
Staley mine	509																													26	75	14	15	16	95	119		8	10		51		40	40		
Strickland Butte mine	10																														1	9														
Taylor Ranch mine	248																												8	63	95	82														
Towner mine	183					1	1								1	1	4	6	8	11						12	5	2	2	10	14	30	31	9	6	27		2								
DOUGLAS COUNTY																																														
Bonanza mine	39,540					2	31	19				183	722	795	1434	977	604	383	593	846	1160		1161	1351	1182	1261	2350	2426	3294	3940	5548	5733	2199	1183	148											15
Elkhead mine	551[b]	261	23	76	56	10	1				1				5																						16									102
Nonpareil mine	90[c]																																							40						50
Red Cloud mine	63																														4	6			8		6	9	30							
GRANT COUNTY																																														
Canyon Creek mine	111			33	12	2	4	56	4																																					
HARNEY COUNTY																																														
Mogul mine	30																													10	20															
Steens Mountain mine	36										10																			5	21															
JACKSON COUNTY																																														
Chisholm property	31																																				1	4	2	6	1	3				14
Cinnabar Mountain mine	63																												2	25		11	10									15				
Mountain King mine	95																												75	20																
War Eagle mine	657																	3	1							4	1		1	5		1	13		8	3										617
JEFFERSON COUNTY																																														
Axehandle mine	152																2												43	44	24	4	6	23	6											
Horse Heaven mine	17,216													201	749	744	349					2					74	674	911	1243	1940	1626	1668	2190	2107	1781	781	176								
LAKE COUNTY																																														
Angel Peak mine	44									10			16	18																																
Glass Buttes mines	596	w	w	w	w	1	2				1			2	87	3																														
LANE COUNTY																																														
Black Butte mine	16,156			w	w	542	615	1							297	45					4								38	208	292	439	540	803	895	788	919	1273	607	912	1618	1549	1312	999	150	2386
MALHEUR COUNTY																																														
Bretz mine	15,185[d]			276		141	710	50			122	322	480	1258	1413	104												6	21	1214	498	819				904	1628	1957	618	226	2414	4				
Opalite mine	12,367[d]										4				8	6										16		11	218	14	434	40	35	285	928	286			143	1280	516	1323	2276	2655	1889	
SMALL MINES*	103	w	w	9	3	1						1		1		3		1	1	3	4				1	1			3	8	9	6	6	14	3	3		3		7			4			3
TOTALS	108,067	274	43	938	943	700	1364	126	4	10	138	513	1224	2276	3995	1893	1049	483	648	868	1177	7	1167	1353	1185	1323	2500	3159	4646	6951	9040	9050	4608	4622	4275	4129	3462	3484	1436	2592	4786	2961	3656	3735	2063	3211

ANNUAL PRODUCTION
OF
INDIVIDUAL QUICKSILVER MINES IN OREGON
1882 - 1970

Statistics chiefly from U.S. Bureau of Mines records with the permission of mine owner or operator. Only mines with known production of 10 flasks or more are listed individually. Output from smaller mines is combined.

[a] Production after 1940 combined with Blue Ridge Mine.
[b] Total production may be several hundred flasks larger.
[c] Brown and Waters estimated production to be about 340 flasks.
[d] Annual figures for Opalite mine and for years 1930-45 for the Bretz mine furnished by Bradley Mining Co.

* Production of mines with total output of less than 10 flasks.

QUICKSILVER DEPOSITS IN OREGON

MISCELLANEOUS PAPER 15